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(54) Simulated fire effect

(57) An imitation solid fuel fire (1) comprises a rear reflector (16), simulated fuel (13) and a moving light source (10, 11). Reflector (16) has silk screen printed regions, e.g. stripes which diffusely reflect light to simulate a flame effect. The stripes may be printed with ink containing aluminium particles or minute glass beads. As the flame effect is perceived between the simulated fuel (13) and its image in reflector (16), it appears to emanate from the middle of a fuel bed.

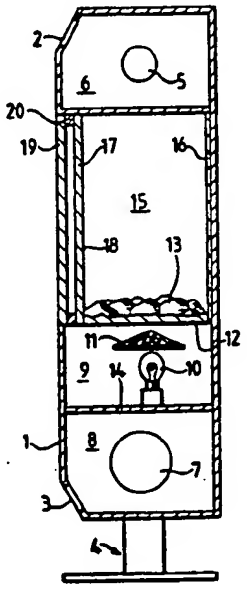

Fig. 1

16 - Reflective

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

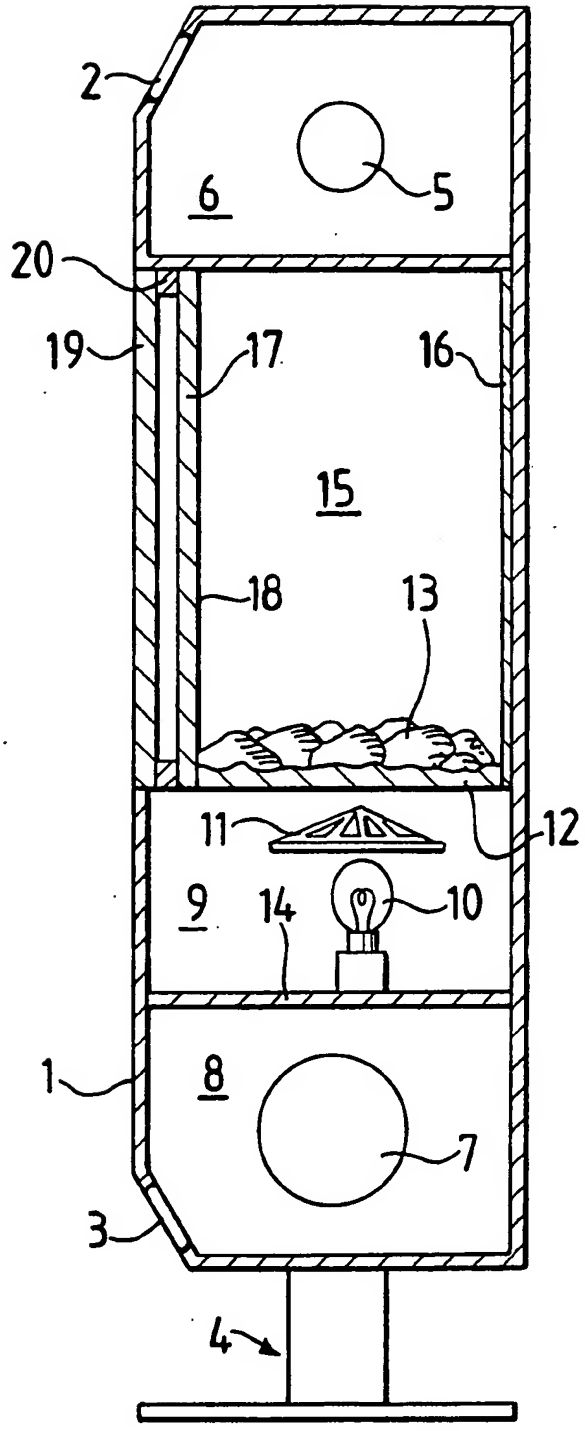

Fig. 1

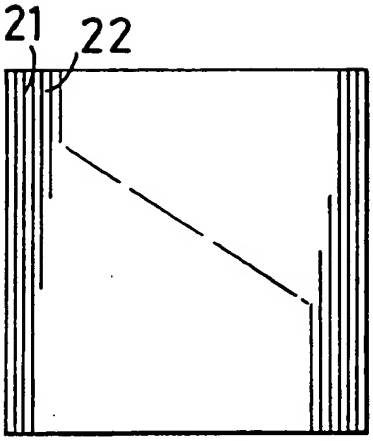

Fig. 2a

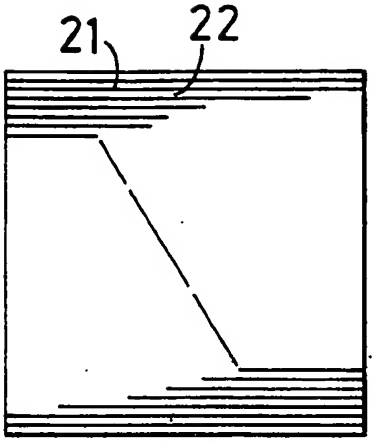

Fig. 2b

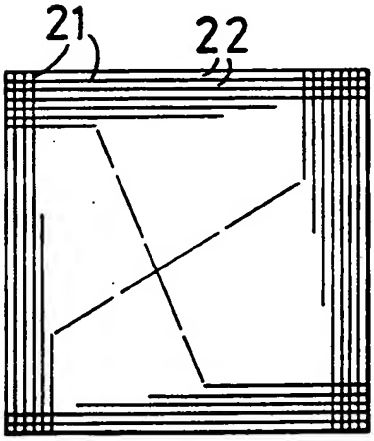

Fig. 2c

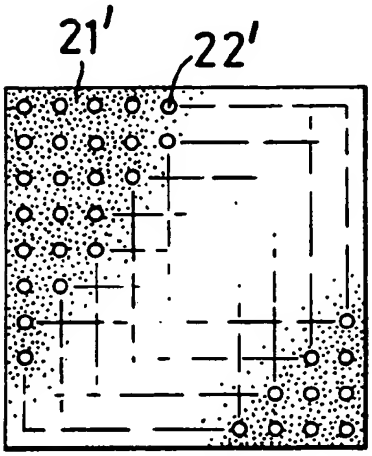

Fig. 2d

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SIMULATED FIRE EFFECT

This invention relates to apparatus including means for simulating combusting fuel and to heating apparatus. Such heating apparatus may include any means for producing a thermal output, for example, a radiant heater and/or convector and/or a fan heater powered by electricity, gas, or any other means and the apparatus may be, for example, free-standing, mounted on a surround, wall-mounted or provided in any other form.

Conventional means for simulating combusting fuel typically include the following components. A semi-translucent cover in the form of a plastics moulding shaped and decorated to resemble pieces of fuel, a housing on which the cover is mounted, a red or orange tinted electric light bulb within the housing and a light circular, multi-blade fan centrally mounted on a pivot pin above the bulb. The fan rotates due to thermal convection currents generated by the heat of the bulb and this provides a flickering effect which simulates, in a crude way, a glowing coal or log fire. However, such conventional means have at least the following disadvantages. The simulation of burning fuel is not really convincing. Dirt and dust can build up on the cover, e.g., due to local convection currents, and this considerably diminishes any realism. The plastics cover can also be seen to be a very poor imitation of simulated burning fuel when the appliance is switched off and it is incongruous in warmer weather when the fire is not required.

Our GB Patent No. 2180927 describes heating apparatus comprising means for providing an improved "fire effect" and this apparatus largely counteracts such problems. The apparatus comprises means for providing a thermal output, means for simulating fuel, a light source

for illuminating the simulated fuel and first and second reflective means arranged to provide front-to-back multiple images of the simulated fuel. The first reflective means is capable of transmitting light as well as reflecting light and the means for simulating fuel is provided between the first and second reflective means. The reflective means are arranged so that the multiple images can be perceived as a visible effect from the exterior of the heating apparatus. This arrangement has several advantages. For example, it creates a kind of "tunnel" imaging effect giving the impression of a deep or extensive fuel bed and this is particularly useful in creating more realism in "slim-line" designs of electrical heaters. The first reflective means, which is part reflective and part transmissive, also protects the means for producing the "fire effect" and thereby prevents the ingress of dirt and dust. Morever, the means for simulating fuel is less noticeable when the light source is switched off and it is substantially obscured when a cover plate is used which is made of, for example, a tinted transparent material such as "smoked glass". The visual effect of burning fuel is therefore not seen when it is not required.

Despite the advantages of the latter arrangement, even more realism is desirable, particularly where this can be achieved without imposing too many constraints on the design or cost of the heating apparatus.

GB 2151772 discloses a flame effect display which includes a hologram which, when illuminated, provides a holographic image of flames, means also being provided for varying the illumination of the hologram to create an effect of flame movement.

Whilst a holographic display may create a more realistic flame display, it has several drawbacks. For example, some holograms are of the kind which, when illuminated by ordinary light, suffer from image cut-off when viewed at certain angles. This can create a severe design problem when considering how a user of a heating appliance may "see" the holographic display. For example, the holographic display may be installed at the back of, and within a ground level electric fire and it may be difficult, or impossible for an observer, who is standing, or sitting close to the fire, or positioned at certain angle to see the holographic display. Moreover, the holographic flames may not be seen as a convincing part of the simulated burning fuel but rather as a separate display. The fact that the holographic display is an image of a model of flames also detracts from realism.

Some other holograms are of a kind which are illuminated by coherent light and these could produce other visible results. However, their use in a domestic electric fire would be impractical for reasons of cost and complexity.

GB 2151772 also mentions the use of switched lamps and colour filters for varying the illumination of the hologram. This would clearly add to the complexity and cost of the installation, as well as increasing the risk of malfunction.

Other earlier prior art attempts to produce more realism (which do not use holograms) have employed translucent screens onto which light is cast in the manner of back-lit image projection. Examples of this are to be found in GB 1457540 and 1024047 and 295110. In GB 1457540, a bulb (8) and means for simulating fuel are situated behind a translucent screen (2). Light from the

bulb (8) illuminates a clear plastics sheet (11) on which dark areas, simulating lumps of coal, are painted; a reflector (5) provides back lighting. This arrangement casts lit areas and shadows onto the rear of the screen. In GB 1024047, a translucent screen (5), made by abrading a clear plastics sheets with a multiplicity of closely-adjacent thin horizontal lines, is positioned part way over a sheet of plastics (7) which is shaped to resemble fuel; an inclined reflector (6) is positioned behind the screen. In this arrangement, some of the light from a bulb (3) is reflected onto the back of the screen - as in the previous arrangement - and the remainder passes directly through the simulated fuel. The opacity of the screen is reduced in places, but this is only to make the simulated fuel visible behind the screen. In both GB 1457540 and 1024047 the translucent screens obscure light and hence severely limit any realism of the "fire effect".

In GB 295,110, a sharply inclined and curved reflector 11 is positioned at the rear of simulated fuel bed (13) and one or more part transparent/part translucent sheets (15, 16, 17) are spaced apart on the fuel bed. This reference teaches only the production of such sheets by darkening a portion of a glass sheet in a suitable way, for instance by a chemical process or smoking. This arrangement appears to depend on light being transmitted directly through the transparent areas to simulate flames and light illuminating the rear of the darkened portions to simulate smoke. It therefore produces only a crude "fire effect" and the sharp inclination of the reflector severely limits the viewing angle of reflected light by an observer.

The present invention seeks to overcome these problems and to provide and enhanced "fire effect" whilst avoiding complexity and/or high manufacturing costs.

In accordance with the invention, apparatus for simulating combusting fuel or heating apparatus having means for providing a thermal output comprises means for simulating fuel, a source of moving light, and means for reflecting light from said light source; said reflecting means having a multiplicity of diffusely reflective regions thereon which are spaced by reflective regions of the reflecting means whereby light which is incident on said reflecting means is both reflected and diffusely reflected so that it can be perceived from the exterior of the apparatus, the reflected light providing an image of the fuel simulating means and the diffusely reflected light simulating a combustion effect.

The source of moving light creates moving beams whereby the angle of incidence of the light falling on the reflecting means is caused to vary. This movement creates a flickering effect, simulating flames, thereby adding to realism.

Preferably, the diffusely reflective regions are stripes of diffusely reflective ink or paint. For example, they may be printed, by silk screening, onto reflective metal sheet. The ink used in such a printing process is preferably of the kind comprising particles or minute beads of material which scatter light such as particles of aluminium, or glass beads, or the like. The stripes may be vertical or horizontal, i.e. with respect to a viewers field of view of the heating apparatus, or part of a network, e.g. formed by screening both vertical and horizontal stripes in separate phases, or by screening a network which could include "holes" (e.g. rectangular or circular) through which the reflective surface of the reflective sheet can be seen.

In apparatus embodying the invention, the reflective means for imaging the simulated fuel is a reflective sheet positioned in a substantially vertical plane at the rear of the apparatus, the means for simulating fuel is located in front of the lower edge of this sheet and means for producing moving beams of light is located beneath the simulated fuel. With this arrangement, a surprisingly effective flame effect is generated by using a reflective sheet in accordance with the invention.

Other advantageous optical effects may be created by including additional reflective means to enable front-to-back multiple images of the simulated fuel to be perceived from the exterior of the heating apparatus. Such an effect is described in more detail in our GB Patent No. 2180927 and it will be understood that the various features of the heating apparatus disclosed therein may be used either singly, or in any combination, to enhance the visual effects created by this invention.

A preferred embodiment of the invention will now be described with reference to the accompanying schematic drawings, in which:

Fig. 1 is a side elevation, partly in section of a radiant/convector heater which incorporates means for providing a "fire effect", and

Fig. 2 illustrates a reflective sheet used in the heater shown in Fig. 1.

Whilst the preferred embodiment will be described with reference to an electrical convector/fan heater, it will be understood that the invention can be applied to

other types of heating apparatus including those which employ means other than electricity for providing a thermal output, or to just means for simulating a fire effect.

The heater shown in the drawings includes an outer casing 1 having ventilation holes 2, 3 and standing on legs 4. Fig. 2 schematically illustrates a convector element 5 located in an upper chamber 6 of casing 1. Similarly, a fan heater 7 is located in a lower chamber 8. A chamber 9 contains a tinted bulb 10 and a thermally driven, circular fan or spinner 11. Only one bulb and fan are shown for ease of illustration and any number of bulbs can be used. The circular fan 11 is centrally pivoted (by means not shown, but of known construction) so that it rotates due to the thermal currents of air produced by the bulb 10 when illuminated. The bulb 10 is preferably tinted red or orange whereby beams of tinted light, intercepted by the blades of the fan 11, are directed upwardly towards a transparent, or translucent plate 12. Sheet 12 supports pieces of tinted glass 13 having irregular shapes and intended to resemble glowing pieces of coal. Sheet 12 preferably has an uneven surface, e.g., it may be a sheet of 'patterned glass'. (Other arrangements are possible, e.g. where ordinary bulbs are used and sheet 12 is tinted.) In alternative arrangement (not shown), the sheet 12 and the simulated pieces of fuel 13 are made as an integral structure, e.g., in the form of a moulded sheet which simulates a bed of fuel and which is at least partially light-transmissive. The front, rear and sides of the chamber 9 are formed by part of the casing 1 which thereby obscure light from bulb 10. The floor 14 of chamber 9 may be either opaque, or it may transmit some light downwardly into chamber 8 whereby a red or orange glow can be seen through the ventilation holes 3.

A chamber 15, which is largely empty except for the pieces of glass 13, is situated between chambers 6 and 9. A sheet 16 of polished metal, such as aluminium, treated in accordance with the invention is located at the rear of chamber 15 in order to reflect light towards a sheet 17 which is at least transparent and preferably partly transparent and partly reflective. Sheet 17 is preferably made of heat-resistant glass with a partially-reflective coating 18 on its inner major surface. Sheets 16 and 17 are substantially parallel whereby multiple images of the simulated fuel 13 may be observed from the exterior of the heater through an optical transparent cover plate 19. Where multiple images are not required, sheet 17 may be omitted so that the observer will then see only one image of the simulated fuel 13 (in reflector 16). However, plate 19 and sheet 17 may also be an integral structure. The cover plate 19 is preferably made of heat-resistant, tinted plastics material which resembles so-called "smoked glass". For example, sheet 19 may be tinted grey or brown or other colours so that it appears to be transparent when chamber 15 is illuminated with light from bulb 10 (see Fig. 1a), and so that it appears to be opaque when bulb 10 is off (see Fig. 1b). The sheet 19 is spaced from sheet 17 by means of a frame 20. Sheet 19 may be just clear where the latter 'opaque' effect is not required. The front surface of sheet 19 is preferably flush with the front surfaces of casing 1 so as to provide a pleasing smooth finish to the front of the heater, especially when chamber 15 is not illuminated (see Fig. 1b).

Sheet 16 is treated by printing fine stripes of ink containing aluminium particles or minute glass beads on its surface. 'Fine' stripes may be, for example, 1 mm

wide. A vertical pattern is depicted in Fig. 2a where the stripes 21 are regularly spaced from one another by bands 22 of the reflective surface of the aluminium sheet (only some of stripes being shown). Preferably, the width of the stripe 21 is equal to the width of the band but the 'pitch' may be varied to produce the optimum optical effect. The sheet 16 may be located in the heater with the stripes running vertically. However, other arrangements including differently shaped diffusely reflective means, may be possible as shown in Figs. 2b-2d. In Fig. 2b, the stripes are horizontal and in Fig. 2c the stripes are both vertical and horizontal. In Fig. 2d, the stripes are generally defined by a network 21' having holes 22' through which the reflective surface of the aluminium sheet can be seen.

The floor of chamber 6 may be opaque, or it may transmit some light which can be perceived, as a tinted glow, through ventilation holes 2.

When the light bulb 10 is switched on, thermal currents of air cause the fan 11 to rotate. Beams of tinted light, intercepted by the blades of fan 11, thereby pass upwardly through sheet 12 and through and/or between the simulated pieces of fuel 13 into chamber 15. These beams of light are incident on the front face of reflector 16 and some of the light falling on the stripes 21 is diffusely reflected out through sheets 17 and 19. This light is perceived through the front cover plate 19 as a flame effect, i.e. the light simulates flickering flames and its realism is surprisingly effective. Since an image of the simulated fuel can be perceived in the reflector 16, the simulated flames appear to emanate from the middle of an extensive fuel bed, which adds to the realism. This

effect is multiplied when the part transparent and part reflective sheet 17 is used to produce multiple images. In this case, the eye-level of an observer standing in front of the heater is normally above the centre of sheets 18, 19 whereby a series of multiple images of the simulated fuel 11 are perceived through the cover plate 19. These multiple images give the appearance of an even more extensive fuel bed stretching back far beyond the rear panel of the heater. This heightens the attractiveness and effect of a glowing fuel bed, especially where the heater is of the contemporary "slim-line" design.

As the chamber 15 can be totally enclosed, this prevents the build up of dirt and dust which would otherwise detract from the "fire effect". However, there may be applications where no front cover plate or plates are used (i.e. both plates 17 and 19 being omitted).

The bulb 10, which may be one of a plurality each located adjacent a respective fan 11, can be connected in series with a dimming switch (of known construction) for adjusting the level of illumination of chamber 15 to an optimum value. Alternatively, a plurality of bulbs may be connected to selective switching means to turn them on or off as required. This is useful where the level of illumination of the "fire effect" may need to be adjusted to suit different levels of illumination of a room in which the heating apparatus is installed. The positions of the bulbs 10 may also be adjustable, if not predetermined, so that an optimum effect is achieved.

CLAIMS

1. Apparatus for simulating combusting fuel or heating apparatus having means for providing a thermal output, the apparatus comprising means for simulating fuel, a source of moving light, and means for reflecting light from said light source; said reflecting means having a multiplicity of diffusely reflective regions thereon which are spaced by reflective regions of the reflective means whereby light which is incident on said reflecting means is both reflected and diffusely reflected so that it can be perceived from the exterior of the apparatus, the reflected light providing an image of the fuel simulating means and the diffusely reflected light simulating a combustion effect.

2. Apparatus according to claim 1 wherein the diffusely reflective regions are stripes of diffusely reflective ink or paint.

3. Apparatus according to claim 2 wherein said stripes are printed by a silk screen process.

4. Apparatus according to any of the preceding claims wherein said reflecting means comprises a reflective sheet positioned in a substantially vertical plane at the rear of the apparatus, said means for simulating fuel being located in front of a lower edge of the latter sheet and said light source being located beneath the simulated fuel.

5. Apparatus according to any of the preceding claims wherein said light source comprises one or more electric bulbs provided with a fan which is driven by thermal convection currents and thereby intercepts light from the bulb.

6. Apparatus according to any of the preceding claims including additional reflective means to enable front-to-back multiple images of the simulated fuel to be perceived from the exterior of the apparatus.

7. Apparatus substantially as herein disclosed with reference to the accompanying drawings.

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